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# GROWING AND USING FABABEANS

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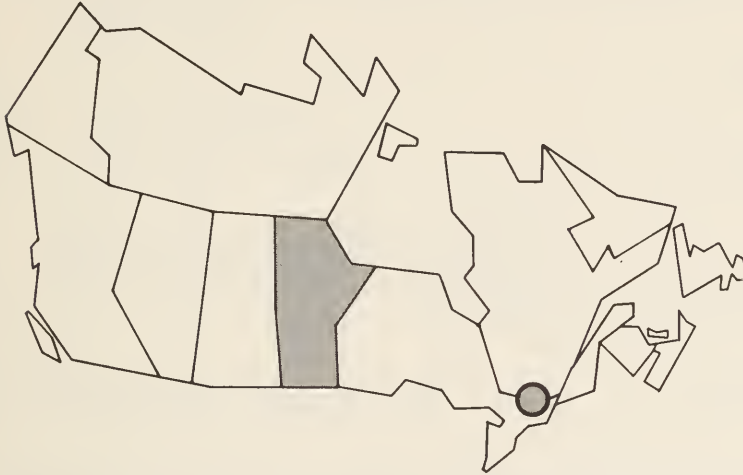
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### **CANADA/MANITOBA**

#### **GROWING AND USING FABABEANS**

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CANADA DEPARTMENT OF AGRICULTURE  
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**GROWING AND USING FABABEANS**

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# GROWING AND USING FABABEANS

## SECTION 1. GROWING FABABEANS<sup>1</sup>

This publication deals with the production (SECTION 1) and uses of fababeans (SECTION 2). Fababeans (*Vicia faba* L.) have been grown in Canada, on a small scale for many years. Recently, because of increased demand for high-protein crops, fababeans (also known as horsebeans and tickbeans) are now being grown commercially. The first commercial production of fababeans occurred in Western Canada in 1972, when about 2000 ac (800 ha) were grown. In 1973, 15,000 ac (6000 ha) were planted and a further expansion is expected in 1974.

Fababeans are being grown as a protein crop to be used primarily in livestock rations. Research results confirm that fababeans can be freely substituted for soybean meal in feeding most classes of livestock. Their use in human consumption also appears promising.

Average yields exceeding 2000 lb/ac (2200 kg/ha) have been obtained in the last 2 years and should increase as producers become more familiar with the crop. The value of this crop is directly related to the price of soybeans and other protein sources.

### DESCRIPTION

Fababeans are small-seeded relatives of the garden broad bean. They are erect-growing (3 to 5 ft) (1-1.5 m), annual legumes possessing excellent straw length.

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<sup>1</sup>Dr. L.E. Evans, Department of Plant Science, University of Manitoba and J.R. Rogalsky, Agronomist, Special Crops, Soils and Crops Branch, Manitoba Department of Agriculture.

The seeds are borne in pods, each containing three or four seeds, and weigh 350 to 550 gm/1000 seeds depending on variety. The plant flowers very profusely but only a small proportion of the flowers produce pods. The pods are borne along the length of the stems, generally starting at 8 to 10 in. (20-25 cm.) from the ground.

Although fababeans are mainly self-pollinated, insects do cause some cross-pollination depending on their frequency and on weather conditions.

The seeds usually contains 25 to 30% protein and are relatively high in energy. Fababeans contain very little oil and can be ground or pelleted without further processing in the preparation of feeds.

## **ADAPTATION**

Fababeans are well adapted to the moister areas of production and thrive under cool growing conditions. High temperatures and low humidity will induce wilting and can be detrimental to seed setting.

From a maturity standpoint, fababeans are relatively late but this can be largely offset by early planting as the seedlings are very frost tolerant. Fababeans have a strong stem and in Eastern Canada may be left in the field to mature before being direct-combined. Alternatively, they may be swathed when up to 40% of the pods have matured and turned black. In Western Canada, where the atmospheric humidity is considerably lower, direct combining is not recommended because of losses due to shattering.

Fababeans fit well into the basic cereal crop rotation followed on many farms. On the prairies they may be grown on summerfallow but have given equal yields on well-prepared stubble land.

Fababeans are subject to many of the diseases attacking other legumes and special crops, so they must be separated from them in the crop rotation.

## **VARIETIES**

Three varieties, Ackerperle, Diana and Erfordia are licensed for production. As outlined in Table 1 these varieties are very similar in yield when grown in Manitoba.

The smaller-seeded varieties are easier to handle with conventional equipment. Diana, the earliest variety, is recommended in areas with short frost-free seasons.

## **SEEDBED PREPARATION AND PLANTING**

The seed should be sown into a moist, firm, weed-free seedbed as early as possible. A seeding rate of 120-160 lb/ac (135-180 kg/ha) is recommended, with the higher rates being used for the larger-seeded varieties. A regular grain drill or disc can be used and should be set to 3 or 4 in. (7.5-10 cm) in depth to ensure good moisture conditions for germination and seedling establishment. Care in seeder adjustment is necessary to avoid seed damage.

**Table 1. Yield Results of Three Varieties of Fababeans**

Variety	cwt/ac	(kg/ha)	% Protein Dry basis	1000 seed wt (g)	Bushel (lb.)	Weight kg/m <sup>3</sup>	Maturity (days)
Ackerperle	29.2	3270	30.0	370	67.0	840	112
Diana	28.6	3200	31.0	435	68.0	850	106
Erfordia	31.4	3520	29.7	475	67.0	840	114

Fababeans are a legume crop and must be inoculated with a specific inoculum to promote nitrogen fixation. The inoculum should be applied in the seedbox just before planting by thoroughly mixing the powdered inoculum with the seed. If seed-borne diseases are suspected, a fungicide treatment with Thiram or Captan is recommended. Other fungicides should not be used as they are lethal to the inoculum.

Fababeans have shown no consistent response to nitrogen fertilization and occasionally it has been detrimental to nodule formation. Nitrogen application, therefore, is not recommended.

To obtain specific recommendations on other nutrients a soil test is preferable. If soil test results are not available an application of 20-30 lb of phosphate (P<sub>2</sub>O<sub>5</sub>)/ac (20-35 kg/ha) is recommended for all soil types. In addition, an application of 15-30 lb of potash (K<sub>2</sub>O)/ac (15-35 kg/ha) should be used on sandy and sandy loam soils.

**WEED CONTROL**

Fababeans are poor competitors with weeds, particularly in the seedling stage. This means that weed control is of utmost importance for successful production of this crop. Unless the grower is certain that he has selected a very clean field for production, fababeans should not be grown without herbicide treatment.

*Chemical* — Treflan is currently the only herbicide registered for weed control in fababeans, and should be considered a ‘must’ in the production of this crop. It will control a wide spectrum of weeds including wild oats, green foxtail, barnyard grass, and broadleaved weeds such as redroot pigweed, lamb’s-quarters, wild buckwheat and Russian thistle. However, it will not control mustard, ragweed or stinkweed, and provides only fair control of smartweeds. Treflan may be applied in the fall or in the spring. Best incorporation can be achieved with two operations of a disc-type implement operated in different directions (cross-disc).

Carbyne has been successfully used for wild oat control in fababeans on an experimental basis. Growers should consult the latest recommendations regarding the use of carbyne.

Research work with dinoseb acetate has indicated good promise for mustard and stinkweed control. Further research with this chemical may be necessary before registration can be granted.

Growers should consult their provincial Agricultural Representative for details on time of application, rates, incorporation methods, and for further developments in weed control chemicals for fababeans.

*Cultural* — In mellow soils the coil spring or diamond harrow may be used for destruction of annual weed seedlings after emergence of the bean plants. However, it should be resorted to only if chemical weed control has failed, or is not available. Harrowing should be avoided during emergence of the bean plants, but may be used when the plants are 2 to 6 in. (5-15 cm) high. A hot, dry day should be chosen for harrowing as this will result in the destruction of the largest number of weeds, and cause least damage to the bean plants. Harrowing in damp weather or when dew is present should be avoided to prevent spread of diseases.

## DISEASES AND INSECTS

Fababeans are subject to a number of diseases which may seriously affect the yield and quality of the crop. Growers should be careful in selecting a field for fababean production as certain diseases may be common to other commercial crops also being grown on the farm.

*Ascochyta Blight* — This disease (*Ascochyta fabae*) is characterized by the appearance of spots on the leaves and pods and, in severe infestations, on the stems as well. The spots on the leaves are usually tan in color and circular in shape. Often the spots will fuse, causing tan blotches with an irregular shape. On the stems the spots are usually reddish brown and more elongated, but may also fuse and give the entire stem a reddish appearance. The spots on infected pods are usually sunken, tan to black colored in the center, and bordered by a dark brown margin. In severe infections, the beans developing in the pods will also become discolored and shriveled. The fungi that cause this disease are mainly seed-borne, but can also live on crop refuse and in the soil.

The most important control measure is the use of disease-free seed. The grower should insist on purchasing only seed that has been disease tested. In addition, the seed should be treated with captan or thiram as a preventive measure. Further to this, fababeans should be grown only once in 4 years in the same field.

*Chocolate spot* — This disease is caused by the fungus *Botrytis fabae* and appears in most fields each year. Leaves, stems and pods may be attacked. On the leaves, the disease causes reddish-brown spots varying in size from small dots to conspicuous lesions. These spots may merge causing blackening, partial or complete defoliation and, in severe cases, death of the plant.

The *Botrytis* fungus is carried from season to season on bean debris and occasionally on seed. Conditions favoring the spread of chocolate spot are not too well defined. Damp, humid weather, poor air circulation, too high a seeding rate and dense weed infestation appear to increase severity of this disease. A number of cultural practices are recommended to minimize crop losses from chocolate spot:

select a field with good air circulation, avoid excessively thick stands, ensure that weed control is adequate, and follow a 3- to 4-year rotation.

*Other diseases* — Fababeans are subject to a number of their diseases which have not caused serious problems to date, but pose as potential threats for the future. These include Sclerotinia stem blight, which is common in sunflowers and rapeseed; Fusarium root rot, which attacks many legume and oilseed crops; a virus disease that causes bean yellow mosaic; and a race of rust to which fababeans are susceptible.

Control measures for prevention of these diseases involve care in planning rotations. Fababeans should follow cereal crops in the rotation, rather than oilseed or legume crops. Once again, fababeans should be spaced a minimum of 4 years apart in the rotation.

*Insects* — No serious insect damage in fababeans has been reported. Although the blister beetle (three species) continues to pose the largest threat, control measures have not been found necessary. Other insects that have caused minimal damage are grasshoppers and aphids. Under certain weather conditions, aphids multiply rapidly. Fields should be checked often as plants approach flowering. If aphids are present, they usually appear in large numbers on the stems and undersides of leaves, generally on the edges of fields.

Growers should check their fields frequently to ensure early detection of insect infestations. If damage becomes apparent, they should seek the advice of their regional agronomist or agricultural representative for recommended insecticides.

## **HARVESTING**

As fababeans mature, the lower leaves darken and drop. Pods turn black and dry progressively up the stem. Fababeans will shatter if left standing until full maturity. In Western Canada, swathing should therefore begin when the lowest two pods show signs of blackening. At this stage the moisture content of the beans will be in the range of 35 - 45%. Research work conducted at the University of Manitoba has indicated that swathing in this moisture range provides the highest bushel weight and 1000-kernel weight. Since this high moisture content will necessitate a fairly long drying period in the swath it is advisable to lay a fairly light swath. In heavy stands this may mean the use of only a partial cut if a large swather is used.

In swathing, very little difficulty is usually encountered, but in severely lodged crops a pickup reel is quite effective. In addition, swathing in only one direction may be necessary.

In Eastern Canada, direct combining is preferred over swathing. In combining, shattering losses at the pickup are a major problem. It is therefore important to closely match the pickup speed to the ground speed. Draper-type pickups have a gentler action than drum types, and tend to carry more beans on to the table. If high shattering losses on the pickup are encountered, combining under dewy conditions in the morning or evening is suggested.

Low cylinder speeds in the range of 300 - 500 rpm are recommended, to minimize splitting and cracking of the beans. An initial concave setting of 3/4 in. (2 cm) clearance in the front and 3/8 in. (1 cm) at the rear may be used. The spacing between concave wires must be wide enough to allow the beans to pass through freely. On most small grain concaves this may mean the removal of every second concave wire.

An initial chaffer setting of 5/8 in. (1.5 cm) may be used. Since fababeans are relatively heavy, high airflow rates are recommended. Return tailings should be kept to a minimum to reduce seed damage. All elevator chains in the combine should be adjusted to remove excess slack. In handling, augers should be run slowly, and dropping the beans from high elevations should be avoided.

Very little information on the mechanical drying of fababeans is available. Rapid drying through the use of high temperatures should be avoided. This often causes stress cracks in large seeds and reduces germination. A maximum temperature of 90°F (32°C) is therefore suggested until more specific information becomes available. In large seeds such as fababeans, the outside area of the seed will dry but the inner core may remain damp. Drying in two stages is therefore recommended if more than 5% moisture is to be removed. Allowing a day or two between operations will give the internal moisture time to move to the surface. A recirculating batch dryer is not recommended for fababeans, as the augers that circulate the seeds may cause excessive cracking and seed damage.

The maximum moisture content currently recommended for safe storage is 15%. Most moisture meters are not calibrated for fababeans. A rough test for moisture can be made by biting the beans. If they can be bitten through and are 'cheesy', they are over 15% moisture. If the beans are hard and remain intact when bitten, they are likely less than 15%.

## **FABABEAN SILAGE**

The fababean plant can be made into silage. Research on fababean silage is limited; however, growing dairy heifers after 42 days on test were eating and gaining on a fababean silage that analyzed 17.5% crude protein, 30% crude fiber and 30% dry matter. The rate of gain was about the same as for animals on grass – legume silage (12% crude protein, 33% crude fiber and 38% dry matter).

The fababean plants in the silage were harvested with very little wilting just after the bottom pods turned black. During the ensiling process the total material gradually became very dark in color.

Fababeans should not be planted as a mixture with cereal grains. They do not compete well with other plants. However, fababeans and barley could be planted, at the appropriate times, in strips and harvested across the strips for a mixed barley-fababean silage.



Figure 1. Plants at stage recommended for swathing (note few blackening pods).



Figure 2. A well nodulated plant (left) resulting from proper use of inoculum and a plant grown without inoculation.



Figure 3. Leaf spotting caused by *Ascochyta* fungus.



Figure 4. Lesions caused by *Ascochyta* on an enlarged pod.

## SECTION 2. USING FABABEANS<sup>1</sup>

Fababeans in Canada appear to have great potential for feeding livestock. Their value arises from their excellent nutritional qualities, universal palatability and ease of preparation. The following recommendations are the result of feeding trials and experiments with farm animals conducted during 1973 by the University of Manitoba, Department of Animal Science.<sup>2</sup>

As a source of protein and energy for use in livestock and poultry feeding, fababeans are palatable, digestible and nontoxic when incorporated, even at quite high levels, in rations for farm animals. The raw unprocessed beans produced on the farm can be coarse-ground or hammer-milled and mixed directly into rations for all classes of stock.

Ground fababeans can replace the traditional soybean meal as a protein supplement for farm animals. When this substitution is made 2 lb (0.8 kg) of fababeans should replace 1 lb (0.45 kg) of soybean meal and 1 lb (0.45 kg) of grain in the ration. This 2 to 1 relationship between fababean meal and soybean meal is essential because the protein content of the fababean is about half that of the soybean. In other respects these two vegetable protein meals are nutritionally similar. When fababean meal replaces soybean meal in the proportions indicated, no alteration is required in the amount or composition of the dietary mineral or vitamin mixtures used in the ration formulation.

### COMPOSITION OF FABABEAN MEAL

Fababeans averaged 26.5% protein (N x 6.25) in 1973 (Table 1). In this regard they exceed by 2 or 3% the protein in peas and beans. Like most plant protein sources, fababeans are somewhat low in the sulfur-containing amino acids, methionine and cystine. They are, however, a comparatively satisfactory source of lysine, being essentially equal to soybean meal on a two for one replacement basis.

Table 2 shows the nutrient composition of the three more important varieties of fababeans grown in Canada.

The energy value of fababeans was derived from poultry data and is expressed as metabolizable energy (ME). Fababean energy (1140 Kcal/lb) is greater than that of soybean meal but somewhat less than that of barley.

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<sup>2</sup>Staff members contributing to Section 2 are: Dr. L.D. Campbell, Poultry; Dr. T.J. Devlin, Beef and Sheep; Dr. J.R. Ingalls, Dairy; Dr. S.C. Stothers, Swine; Dr. M.E. Seale, Dept. Chairman.

**Table 2. Average Nutrient Content of Fababeans (1973)**

	Ackerperle	Diana	Erfordia	Average
Dry matter, %	85.62	84.61	85.77	85.44
Crude Fiber, %	9.17	10.22	8.81	9.24
Fat, %	1.00	1.00	1.00	1.00
Crude protein, (As is) %	26.40	26.43	26.67	26.51
Crude protein, (dry) %	30.81	31.24	31.08	31.00
Calcium, %	0.09	0.08	0.08	0.08
Phosphorus, %	0.48	0.40	0.42	0.43
T.D.N. (swine)	71.81	70.37	72.04	71.60
M.E. (kcal/lb)	—	—	—	1140
or kcal/kg	—	—	—	2500
Lysine, %	1.69	1.62	1.68	1.68
Methionine, %	0.19	0.20	0.19	0.19
Cystine, %	0.27	0.27	0.29	0.28
Bu Wt, lb	67.20	66.20	67.90	67.51
Bu Wt, kg	30.55	30.00	30.56	30.50

### FABABEANS FOR SWINE

If barley is used as the grain portion of a swine ration for growing-finishing pigs, fababeans may replace all the supplemental protein usually supplied by soybean meal. For the practical swine feeder a ration may be self-fed, hand-fed or used with an automated feed system. At this time it is not recommended that fababeans be used extensively with newly weaned pigs until they have reached a weight of 70 to 75 lb. Research to date indicates that special premixes including methionine and/or heat treatment, such as pelleting, would be necessary for good results.

Some preliminary trials with fababeans for lactating sows have given satisfactory results. A mash ration at a level of 25% fababeans was used in this test. Little or no protein supplementation is required in most dry sow rations. If protein supplement is needed fababeans can be used. The grower and finisher rations shown in Table 3 have been used successfully when combined with a suitable mineral-vitamin premix.

### FABABEANS FOR POULTRY

Studies at the University of Manitoba indicate that fababeans are very palatable for poultry. Experimental diets containing as much as 90% fababean meal have given satisfactory results. More-practical diets for laying hens and growing turkeys (25% ground fababeans) and broiler chickens (20% ground fababeans) have resulted in production performance comparable to that obtained from standard (commercial type) diets.

The use of ground fababeans in light breed layer diets resulted in egg production equivalent to the standard ration in one trial and slightly inferior production in

Table 3. Rations for Growing and Finishing Swine

	Growing rations			Finishing rations		
	— lb or kg —			— lb or kg —		
Barley	650	737	337	825	895	750
Wheat	—	—	300	—	—	—
Fababean meal	300	150	338	150	75	225
Soybean meal	—	63	—	—	—	—
Mineral - Vitamin Mix*	50	50	25	25	25	25
Total	1000	1000	1000	1000	1000	1000
Protein %	14.6	14.6	—	12.8	13.04	13.87

\*Most commercially available mineral - vitamin premixes include: Calcium, phosphorus, iron, salt, zinc, iodine, vitamins A, D, E, and B<sub>12</sub>

another. In both trials egg weight was depressed by the inclusion of ground fababeans in the ration. The results of these preliminary trials are very encouraging and further work is in progress to determine how to use fababeans most effectively in poultry diets, with special emphasis on laying hen rations.

Examples of fababeans included in chicken broiler, laying hen, and turkey diets are shown in Table 4.

FABABEANS FOR DAIRY CATTLE AND CALVES

In rations for dairy cattle fababeans may be used to replace soybean meal, rapeseed meal or other vegetable protein supplements. Except for coarse grinding, fababeans require no further processing. They are a source of protein that the dairyman can produce and use on the farm.

Feeding trials at the University of Manitoba indicate that fababeans can make up to 35% of the dairy concentrate without adversely affecting the production or composition of milk. Possibly higher levels of fababeans could be included in dairy rations but no experiments have been conducted here with higher levels. The bean may constitute up to 25% of the total calf ration without retarding feed intake or reducing growth.

Lactating Cows

The total ration for cows producing up to 55 to 60 lb (25 to 27 kg) of milk a day should contain 12% crude protein on an as-fed (87% dry matter) basis. For production levels over 65 lb (30 kg) the total ration should contain 14% crude protein on an as-fed basis.

The level of protein required in the dairy concentrate mixture depends on the level of protein in the roughage and the amount of each that is fed. Practical dairy concentrate mixtures will contain 12 to 18% crude protein. Examples of dairy

**Table 4. Typical Poultry Diets Utilizing Ground Fababeans**

Ingredients	— lb or kg —			
	Broiler starter	Broiler finisher	Turkey grower	Light-breed layer
Fababean (ground)	200.0	200.0	250.0	255.0
Wheat	481.0	530.0	488.0	465.0
Oats	—	—	—	100.0
Soybean meal (48.5%)	177.0	134.0	133.0	—
Fish meal	34.0	20.0	20.0	—
Meat meal	—	—	10.0	56.5
Dried distillers solubles	—	—	—	25.0
Dehydrated alfalfa	20.0	20.0	10.0	—
Tallow	40.0	45.0	45.0	5.0
Ground limestone	3.0	4.0	5.0	12.5
Oystershell	—	—	—	37.5
Defluorinated rock phosphate	20.0	22.0	22.0	12.5
Grit	—	—	—	25.0
Vitamin-mineral premises <sup>1</sup>	25.0	25.0	17.0	6.0
Total	1000	1000	1000	1000

<sup>1</sup> Contain vitamin, salt and trace minerals necessary to balance the respective diets. In addition each diet contained the following level of supplemental methionine (expressed as a % of total diet) broiler starter .087, broiler finisher .094, turkey grower .105, laying hen 0.10.

concentrate mixtures using fababean, soybean and rapeseed meal as supplementary protein are shown in Table 5.

### Dairy Calves

Fababean meal may replace other vegetable protein supplements in both calf starter and grower rations. Calf starters that are fed free choice, and make up essentially all the dry matter intake, should contain 14 to 16% crude protein (87% dry matter). It is assumed that up to 6 or 7 weeks old a calf will not utilize urea. For calves 7 weeks to 5 months old, 12% crude protein (87% dry matter) in the total ration is adequate and urea may be used as part of the protein requirement. The level of crude protein for a calf grower ration depends on the ratio of grain to roughage that is fed and the level of protein in the roughage.

### Calf Starter

Rations 4, 5, 6, 8 and 9 in Table 5 may be used as calf starters by adding 20 lb (9 kg) of ground limestone, 60 lb (27 kg) molasses and 15 gm antibiotic/ton of feed. Calves should receive colostrum for the first 3 days and milk or milk replacer for the next 4 to 5 weeks together with calf starter fed free-choice. The latter may be continued free-choice to 7 weeks of age.

Table 5. Examples of Dairy Concentrate Mixes That Contain Fababeans, Soybean Meal and Rapeseed Meal

Ingredients	Rations in lb or kg										
	12% crude protein	14% crude protein	16% crude protein	18% crude protein	18% crude protein	18% crude protein	18% crude protein	18% crude protein	18% crude protein	18% crude protein	18% crude protein
	1	2	3	4	5	6	7	8	9	10	11
Barley (11%) <sup>*</sup>	502	270	521	373	132	274	412	304	—	292	206
Oats (10%) <sup>1</sup>	300	300	300	300	300	300	300	300	305	300	300
Wheat (14%) <sup>2</sup>	—	300	—	—	300	—	—	—	300	—	—
Fababeans (25%)	150	80	120	280	220	350	230	250	350	350	350
Soybean meal (44%)	—	—	—	—	—	30	—	—	—	—	100
Rapeseed meal (36%)	—	—	—	—	—	—	—	100	—	—	—
Urea <sup>3</sup>	—	—	10	—	—	—	10	—	—	12	—
Molasses	30	30	30	30	30	30	30	30	30	30	30
Rock phosphate <sup>4</sup>	8	9	8	6	7	5	7	5	5	5	3
Trace mineral salt <sup>4</sup>	10	10	10	10	10	10	10	10	10	10	10
Vit. A + D Supplement <sup>4</sup>	1	1	1	1	1	1	1	1	1	1	1
Total	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

\* Bracketed figures indicate protein levels.

<sup>1</sup> Oats — not more than 50% of dairy mix because of low energy concentration.

<sup>2</sup> Wheat — not more than 65% of the dairy mix.

<sup>3</sup> With present prices, the use of urea in place of vegetable protein will reduce the cost. There is recent concern however, that urea is not well utilized by the dairy cow producing more than 65 - 70 lb (30-32 kg) of milk per day which will require a total ration containing 14% crude protein on an "as fed" basis. Urea should therefore be used in dairy mixes for cows producing less than 70 lb (32 kg) of milk per day.

<sup>4</sup> These mineral and vitamins may be replaced by commercial premixes (for amounts to use follow manufacturer's directions).

## **Calf Grower**

Rations 1 to 5 in Table 5 may be used as grain mixes for calves from 7 weeks to 5 months of age. Either of the following practices could be utilized for growing calves.

(a) Coarsely ground, good-quality hay may be added to the grain mixes as 10 to 20% of the total, plus 1% ground limestone, and all fed free-choice. This type of diet should result in gains of about 1.7 lb (0.8 kg) /day and require 3 to 4 lb (1.4 to 1.8 kg) of feed/lb of gain.

(b) The grain mixes plus 1% ground limestone could also be fed up to a maximum of 4 or 5 lb (1.8 or 2.2 kg)/day along with good quality forage fed free-choice. Low levels of a recommended antibiotic can be included in the grain mixture.

With average-quality hay fed free-choice and 4 lb (1.8 kg) of dairy concentrate daily, heifers should make a satisfactory growth rate from 5 months to breeding weight. For most heifers from 5 months of age to calving, very little supplementary protein is required. During this period the total diet need only contain 9% crude protein (87% dry matter).

## **FABABEANS FOR BEEF CATTLE**

Fababeans can be incorporated into rations as a protein source for growing and finishing beef cattle.

If fababeans are used, as with all protein supplements, the other nutrients required for the particular class of cattle should be balanced for vitamins and minerals.

### **Wintering Calves**

Calves can be wintered on a wide variety of feedstuffs. Depending on the quality of the feed available, very little protein supplement may be required.

When calves are wintered on grain and poor-quality roughage or straw, supplementary protein is required and fababeans can be usefully incorporated in the ration. An example is given in Table 6. As with any other feedstuff, this ration should be introduced slowly to the cattle and they must be watched closely for signs of digestive upsets or overeating. Beans should not be ground too finely — a coarse grind is recommended.

### **Feedlot Cattle**

Fababeans can be used to increase the protein content of finishing rations for cattle. Usually, the level of fababeans required is not high, particularly if the main grains used are wheat, barley or oats. Rations using fababeans as a protein source with barley or oats are given in Table 6.

Table 6. Rations for Beef Cattle

Ingredients	— lb or kg —			
	Wintering calves <sup>1</sup>	Feedlot steers <sup>2</sup>		Gestating cows <sup>3</sup>
Barley	584	1834	718	1400
Oats	—	—	1000	—
Fababeans	300	66	192	600
Urea	30	—	—	—
Molasses	60	60	50	—
Straw	1000	—	—	—
Calcium phosphate	16	20	20	—
Limestone	—	10	10	—
Trace salt mix	10	10	10	—
Vitamin A	+	+	+	+
Vitamin D	+	+	+	+
Total	2000	2000	2000	2000

<sup>1</sup> Add 4,000,000 IU vitamin D per ton (909 kg) to each grain mix. The straw was ground and a complete ration fed.

<sup>2</sup> Add 3,000,000 IU vitamin A per ton (909 kg).

<sup>3</sup> Vitamin A and a trace salt mix should be available free choice. This grain mixture should be fed to cows provided with straw or poor quality hay free choice. About 5 to 8 lb (2 to 4 kg) per day is suggested. If the cows are losing condition the grain ration should be increased to 10-12 lb (5-6 kg) per day.

Gestating and Lactating Cows

(1) Gestating cows fed average-quality hay do not usually require supplemental protein. With poor-quality hay or straw as the wintering ration, some grain and supplemental protein is necessary to maintain cow weight during the gestation period. Condition of the animal and severity of the winter will determine how much energy and protein are required from the supplement. An example of a ration for gestating cows is given in Table 6.

(2) Lactating cows require additional energy and protein after calving and fababeans can serve as a source of both nutrients. A combination of barley (94%) and fababeans (6%) contains about 12% protein (depending on the protein value of the barley and the beans). This mixture fed at 10 to 12 lb (4.5 to 5.4 kg)/head/day along with average quality hay should supply the energy and protein required for the average lactating beef cow. Mineral should be supplied free choice and vitamin A should be included in the grain mix or injected into the animal.

FABABEANS FOR SHEEP

Fababeans in rations for sheep, although serving mainly as a protein source, are also a source of energy. There do not appear to be any restrictions in using the ground beans in ewe, ram or lamb rations if they are used to provide supplementary protein.

Quality of protein is not a factor when feeding sheep, but quantity of protein is extremely important. Insufficient total protein results in reduced appetite, lowered feed intake and reduced feed efficiency. Lowered feed intake results in unsatisfactory growth, muscular development, reduced reproductive efficiency and reduced wool production. When protein is limited, whether it be for body growth, milk production or wool growth, the dietary use of fababeans should correct the deficiency.

### Growing and Finishing Lambs

After weaning, lambs require a ration containing 12 to 13% protein. Fababeans can be used to supplement barley or oats in the grain portion of the ration. If good-quality roughage (above 12% protein) is also fed, no additional protein is required. If, however, roughage low in protein is used the addition of fababeans to the grain ration will be beneficial by increasing the percentage of protein in the total ration to 12 to 13%. Example rations for lambs are given in Table 7.

In experiments in which fababeans have exceeded 25% of the ground grain ration along with limited amounts of roughage (less than 1½ lb (0.22 kg)/head/day) slight reduction in gain and feed efficiency has been observed. This reduction was overcome by pelleting the grain portion of the ration.

### Ewes

(1) *Gestating* — Ewes receiving good quality hay seldom require any protein supplementation. If poor-quality hay or straw is used, a supplemental grain-fababean combination will supply added protein and increase energy consumption. If poor-quality roughage is fed free-choice, then a 60-40 mixture of oats-fababeans

Table 7. Fababeans in Grain Rations for Finishing Lambs

Ingredient	— lb or kg —		
	Ration #1 <sup>1</sup>	Ration #2 <sup>2</sup>	Ration #3 <sup>3</sup>
Barley	1718	1458	1478
Fababeans	240	500	320
Rapeseed Meal			160
Dicalcium phosphate	30	30	30
Trace salt mix	12	12	12
Vitamin A	+	+	+
Vitamin D	+	+	+
Total	2000	2000	2000

<sup>1</sup> Vitamin A added at one million IU per ton (909 kg) and Vitamin D added at 200,000 IU per ton (909 kg). This grain mix is suggested when good quality hay is provided.  
<sup>2</sup> Add vitamin A and vitamin D as in Ration 1. This grain mix can be used with average quality hay.  
<sup>3</sup> Add vitamin A and vitamin D as in Ration 1. This grain mix can be fed with poor quality hay but in a finishing program the hay should not make up more than 30% of the total ration.

should be fed at about 1 lb (0.45 kg)/head/day. If during the last 6 weeks of gestation poor-quality hay or straw continues to be fed, the 60-40 oat-fababean mix should be increased to 1<sup>1</sup>/<sub>2</sub> lb (0.68 kg)/head/day plus vitamins, minerals and salt either free-choice or added to the grain mixture. If better-quality roughage can be made available during this critical last 6 weeks of gestation the 60-40 oat-fababean mixture can be continued at 1 lb (0.45 kg)/head/day.

(2) *Lactating* – After lambing, ewes require both additional energy and additional protein. To meet the protein requirement for milk production a 60-40 barley-fababean mix could be used at a level of 1<sup>1</sup>/<sub>2</sub> to 2 lb (0.68 to 0.9 kg)/head/day, along with average-quality hay fed free-choice. This should be continued as long as the lambs are nursing. Vitamins, minerals and salt should also be offered free-choice or included in the grain mix.

**Rams**

For ram lambs and yearlings fababeans can be used to increase the protein content of the ration (11 to 12%) for young lightweight animals. The addition of fababeans to a grain ration fed at a low level, will not only supply the additional protein but also supply energy which will be required when a roughage ration is being fed (at least until the lambs reach 100 to 110 lb (45 to 50 kg)).

**Table 8. Comparative Composition of Whole Beans, Dehulled Beans and Hulls**

	Whole bean	Dehulled portion	Hulls only
	%	%	%
% of whole bean	100	86.7	13.3
Protein (N X 6.25)	25.9	27.6	6.2
Dry matter	88.6	88.3	90.0
Fat	1.3	1.4	0.3
Fiber	8.7	3.1	45.2
Ash	2.7	2.8	2.5

## CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
<b>LINEAR</b>		
millimetre (mm)	x 0.04	inch
centimetre (cm)	x 0.39	inch
metre (m)	x 3.28	feet
kilometre (km)	x 0.62	mile
<b>AREA</b>		
square centimetre (cm <sup>2</sup> )	x 0.15	square inch
square metre (m <sup>2</sup> )	x 1.2	square yard
square kilometre (km <sup>2</sup> )	x 0.39	square mile
hectare (ha)	x 2.5	acres
<b>VOLUME</b>		
cubic centimetre (cm <sup>3</sup> )	x 0.06	cubic inch
cubic metre (m <sup>3</sup> )	x 35.31	cubic feet
	x 1.31	cubic yard
<b>CAPACITY</b>		
litre (L)	x 0.035	cubic feet
hectolitre (hL)	x 22	gallons
	x 2.5	bushels
<b>WEIGHT</b>		
gram (g)	x 0.04	oz avdp
kilogram (kg)	x 2.2	lb avdp
tonne (t)	x 1.1	short ton
<b>AGRICULTURAL</b>		
litres per hectare (L/ha)	x 0.089	gallons per acre
	x 0.357	quarts per acre
	x 0.71	pints per acre
millilitres per hectare (mL/ha)	x 0.014	fl. oz per acre
tonnes per hectare (t/ha)	x 0.45	tons per acre
kilograms per hectare (kg/ha)	x 0.89	lb per acre
grams per hectare (g/ha)	x 0.014	oz avdp per acre
plants per hectare (plants/ha)	x 0.405	plants per acre





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